Volume 073
Article
04

RE-ESTABLISHMENT OF SHOSHONE SCULPIN (*COTTUS GREENEI*) IN THE HAGERMAN VALLEY, IDAHO

Final Report to:
The Nongame Program,
Idaho Fish & Game Department

15 October 1984

Dr. Jack Griffith
Daniel M. Daley
Department of Biological Sciences
Idaho State University
Pocatello, Idaho 83209

INTRODUCTION

The Shoshone sculpin (Cottus greenei, family Cottidae) is found only in the Hagerman Valley area of southcentral Idaho and nowhere else in the world. It is considered a species of special concern by the Idaho Chapter of the American Fisheries Society because of its restricted distribution and vulnerability. In 1979, the U. S. Fish & Wildlife Service was petitioned for a status review of C. greenei in order to consider its listing as a threatened/endangered species. The Office of Endangered Species initiated a status review **in** March 1980, and a report on the distribution, relative abundance, life history and habitat preferences was completed by personae' of the University of Idaho and Idaho State University in 1982 (Wallace, et al., 1982). The Shoshone sculpin is currently on a list of species being actively considered for ,threatened/endangered status by the Office of Endangered Species.

Shoshone sculpin are found in approximately two dozen springs/streams in the Hagerman Valley (Wallace, et al., 1984, Fig. 1). With two exceptions, C. greenei populations have been found only in Gooding County. Most sites were within the Thousand Springs formation along the north bank of the Snake River between River Miles (RM) 565.8 and 590.5. Only two localities containing C. greenei were found on the south side of the Snake River in Twin Falls County. An unnamed spring flowing into the Snake River at RM 566.6 contains a very small population of Shoshone sculpin. At RM 588.3, a few C. greenei were found in the outflow from the private fish hatchery. Their water supply is collected from Box Canyon Springs, immediately across the Snake River, and piped to the south bank where the hatchery is located. Apparently, some individual

sculpin have been transported across the Snake River with the water that is diverted to this hatchery. The most upstream collection has been made in Briggs Springs at RM 590.5. There are many additional springs entering the Snake River above this site, but intensive sampling and an analysis of existing collections of sculpins from these areas has revealed only the mottled sculpin, Cottus bairdi.

Most locations that have been sampled contain small populations of Shoshone sculpin, often only a few dozen to a few hundred. At least four sites, however, support populations of thousands of Shoshone sculpin. Two of these sites, Box Canyon and Blue Hearts Springs, are entirely or partially on public lands administered by the Bureau of Land Management. The third site, Sand Springs Creek, is under private ownership, as are most of the springs supporting smaller populations of C. greenei. Riley -Creek, a stream containing a fairly large population of C. greenei, flows through state and federal fish cultural stations and a state wildlife management area. Most populations in this stream, however, are located in the various springs feeding the creek and in the hatchery raceways.

A fourth large population was "discovered" in July 1984 when the opportunity to sample springs on the Ritter estate at RM 584.7 and 585.7 occurred. The springs at RM 585.7 had previously been identified as holding Shoshone sculpin, but the population had - t been inventoried in detail. Under sponsorship of the Nature Conservancy, the spring was inventoried and was found to hold a population of approximately 40,000 C. greenei. The property is now being offered for sale, and The Nature Conservancy is attempting to purchase the springs or arrange for their

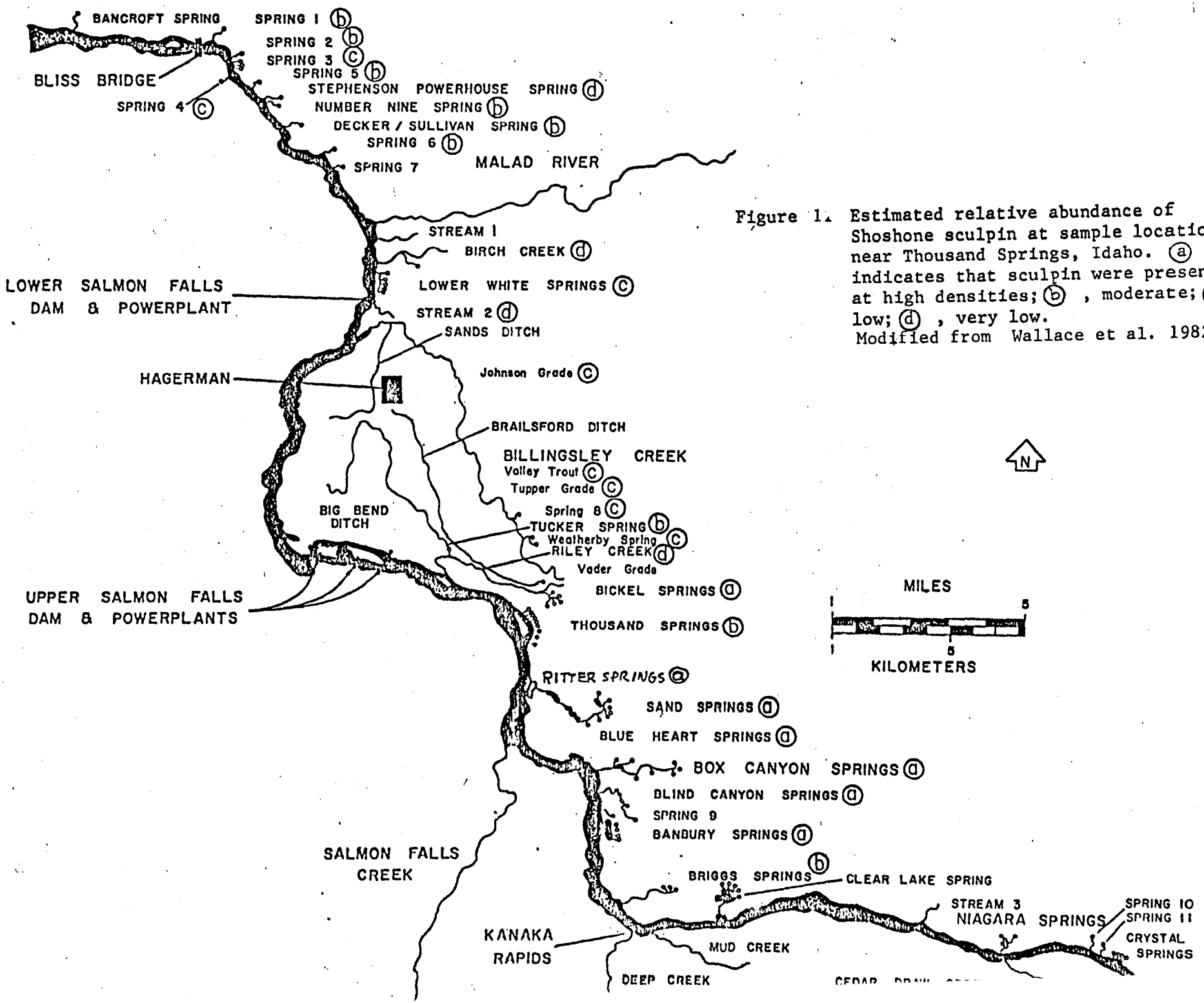

Figure 1. Estimated relative abundance of Shoshone sculpin at sample locations near Thousand Springs, Idaho. (a) indicates that sculpin were present at high densities; (b), moderate; (c), low; (d), very low. Modified from Wallace et al. 1982.

continued protection, but if this effort is not successful the population of sculpin will likely be impacted or eliminated by diversion of the springs.

There are a number of springs not presently inhabited by Shoshone sculpin that presumably are within the original range of the species. Most of these springs are now inhabited by the mottled sculpin (C. bairdi), a species that attains a larger size and one that is widespread throughout northern North America. Mottled sculpin are known to prey upon the Shoshone sculpin. -

The Shoshone sculpin are short-lived, with few living longer than 3 years and reaching sizes larger than 90 mm. Their diet is largely aquatic insects and plankton. Their habitat is essentially restricted to the clear, cool (16°C year-round), well oxygenated water of the Thousand Springs Formation. They select low velocity waters with abundant gravel, rock, and aquatic vegetation. Average densities up to 12 fish per square meter of stream surface are found under optimal conditions (Daley, et al., 1982).

Because of the value of the Thousand Springs for other purposes, especially trout culture and generation of hydropower, this habitat is rapidly disappearing.. The rate of change is faster than that facing any animal species in the state of Idaho. The proposed Wiley Dam, for example, would eliminate or seriously impact about one-third of the existing populations. It is entirely conceivable that the bulk of the habitat available for the *Shoshone* sculpin will be gone within 10 years.

It is the goal of biologists working with the Shoshone sculpin that several (4-5) substantial populations be "secured" in habitat that will

remain in its natural state in the future. At present, only one population (Blue Heart Springs, administered by the Bureau of Land Management) fits that category.

The overall objective of the project outlined in this report is to establish additional "secure" populations of Shoshone sculpin by re-introducing fish into areas within their native range but which are not now inhabited by the species. Specific objectives were to:

1. Evaluate the success of a pilot introduction of Shoshone sculpin in a small spring (referred to as "Sculpin Spring" in this report) on Idaho Fish & Game Department property.
2. Evaluate the suitability of four sites selected by the Idaho Department of Fish & Game for potential future establishment of Shoshone sculpin populations. ,

SUCCESS OF PILOT INTRODUCTION

On 15 August 1983, Shoshone sculpin were seined and dipnetted from spring ponds on the grounds of the Hagerman National Fish Hatchery. A total of 419 fish were collected, of which approximately 40% were smaller than 30 mm in length. The fish were transported to Sculpin Spring and released there within a few hours of their capture.

Pre-introduction inventory:

Sculpin Spring enters the north side of the Snake River at River Mile 600.2 (Fig. 2) between the Niagara Springs and Crystal Springs Hatcheries. A pond of approximately 1,000 m^2 in surface area is created when water is backed up either by high water level in the Snake River or spring flow that exceeds the capacity of the road culverts (Fig. 3) Flow ranged

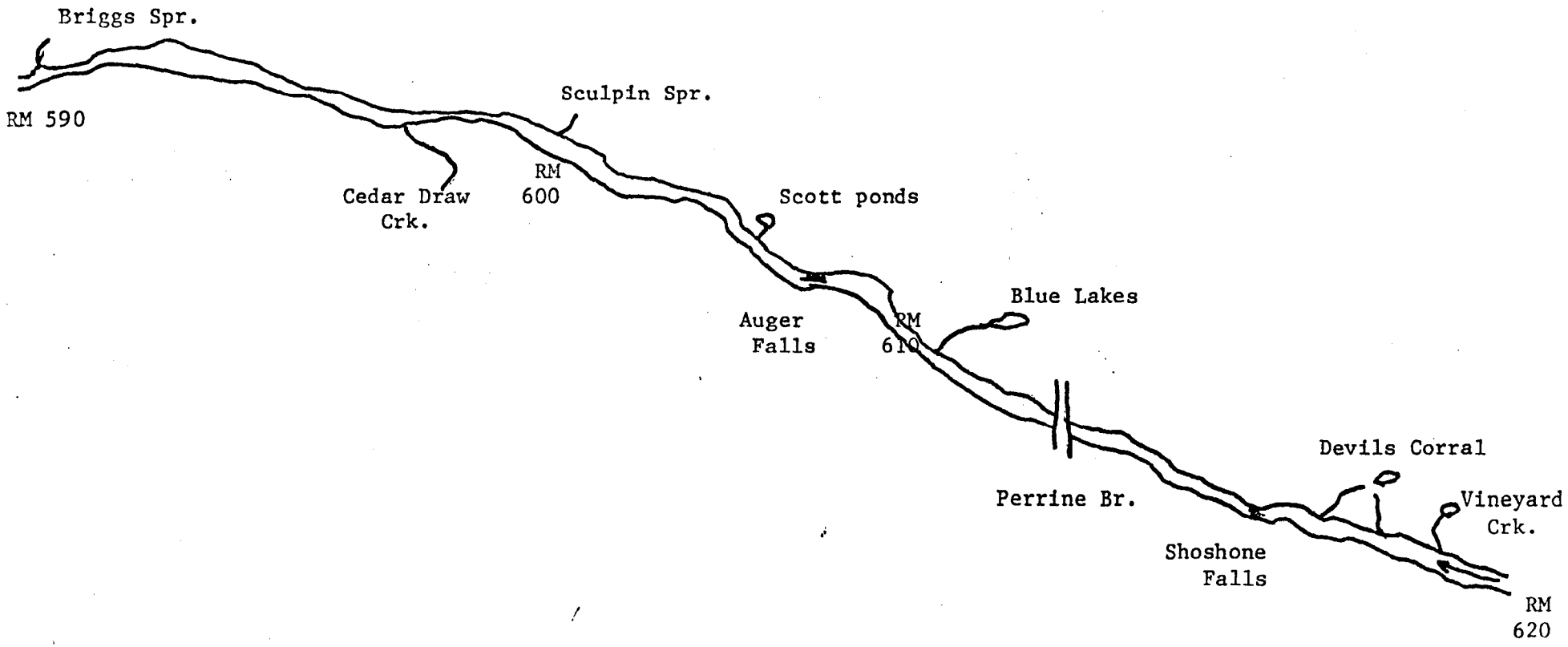

Figure 2. Location of areas examined for possible introduction of Shoshone sculpin.

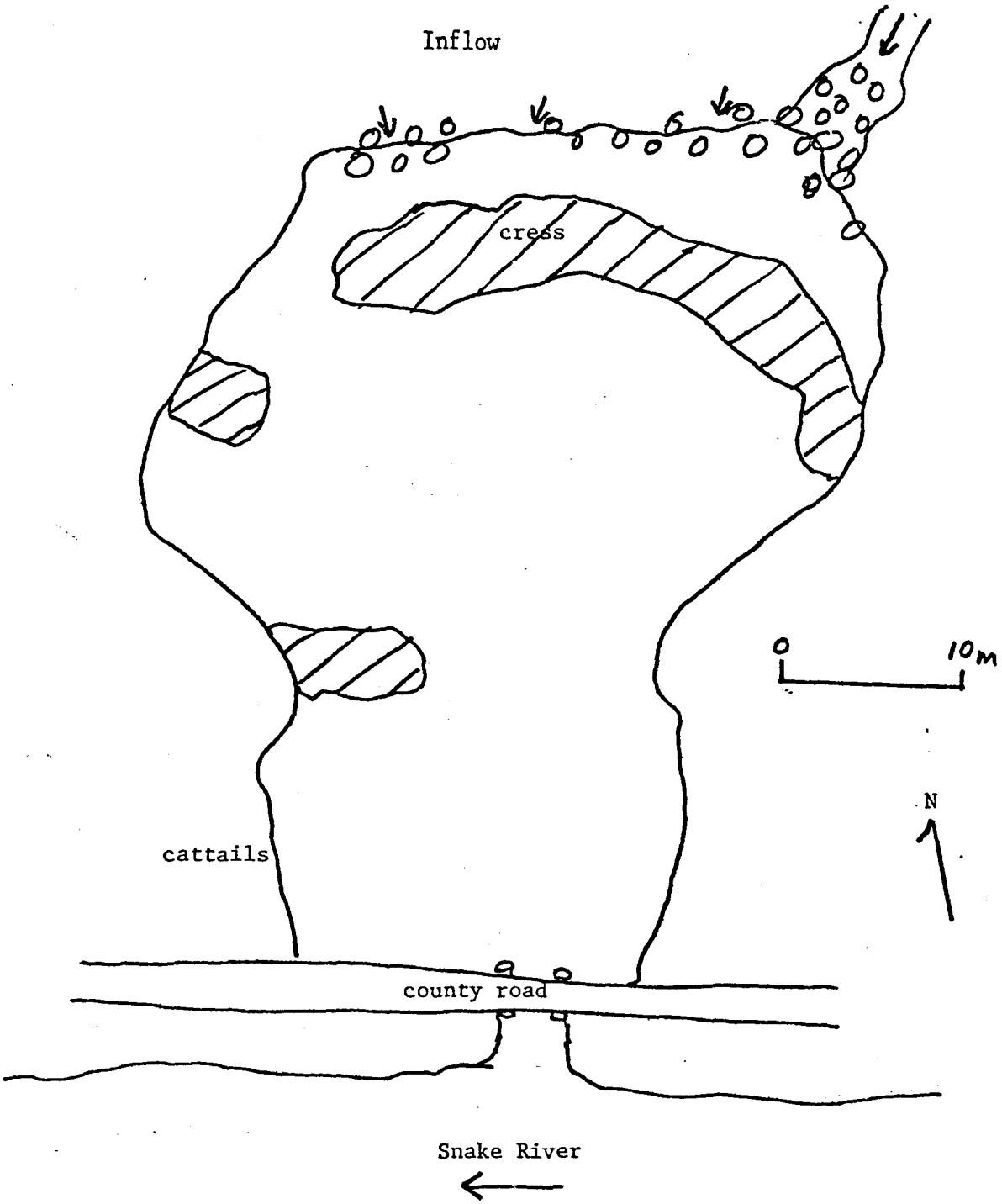

Figure 3. Sculpin Spring.

from approximately 0.3 to 0.6 m^3/sec during the times we sampled in the spring. Water temperature ranged from 13.8^{0}C in November 1983 to 14.0°C in September 1984.

Prior to introduction of Shoshone sculpin, a biological inventory was made of the spring on 13 August 1983. Benthic invertebrate populations were sampled using a 0.1 m^2 modified Hess sampler with um mesh. Four samples were taken at arbitrary locations within Sculpin Spring in February 1983 and in August 1983. Both benthos sampling dates were prior to the introduction of Shoshone sculpin to the spring. Winter invertebrate populations were dominated by gas..ropods, amphipods (Hyalella azteca), and pelecypods (primarily Sphaerium spp.). Total numbers of invertebrates were considerably lower in August 1983 but the same taxa remained dominant (Table 1). Of these dominant taxa, amphipods have been shown to be the group most significantly utilized by Shoshone sculpin (Connolly, 1983). However, other taxa utilized by Shoshone sculpin, such as dipterans, trichopterans, and oligochaetes are present in numbers comparable to those present in Sand Springs Creek, a spring supporting a dense population of Shoshone sculpin. In view of the Shoshone sculpins' apparently opportunistic feeding habits (Connolly, 1983), we did not feel that food availability would be a limiting factor in the success of an introduction to Sculpin Spring.

Quantitative samples of fish density were also taken on 13 August 1983 prior to introduction of Shoshone sculpin. Quantitative samples of sculpin density were taken using a 1 m^2 weighted frame enclosed with fine-mesh nylon on four sides, but with an open top and bottom. The frame was dropped at randomly selected locations within the area being

Table 1. Mean number and standard error of invertebrates/m^2 at Sculpin Spring, Idaho, as estimated by four Hess samples on 20 February 1983 and 13 August 1983.

Taxon	February		August	
	Mean Number	Standard Error	Mean Number	Standard Error
1′bmatoda	3	3	0	0
Oligochaeta	697	542	68	45
Cladocera	230	182	118	87
Ostracoda	207	116	40	34
Crustacea				
Amphipoda	5073	2115	1040	454
Decapoda	3	3	15	10
Arachnoidea				
Hydracarina	757	347	385	191
Insecta				
Ephemeroptera	57	18	302	136
Odonata	53	53	18	9
Trichoptera	530	163	240	106
Coleoptera	7	7	20	14
Diptera	1417	1192	138	59
Mollusca				
Gastropoda	6003	3254	1488	965
Pelecypoda	1797	1553	760	757

sampled. Electric current from a back-pack electroshocker was then applied within the frame and all sculpin within the 1 m^2 were collected, examined, and released. Mottled sculpin were taken in all 11 frame samples. An average of 2.7 mottled sculpin per square meter (standard deviation 1.49) ranging in size to 90 mm was taken, indicating an overall population of about 2700 mottled sculpin in Sculpin Spring before introduction of Shoshone sculpin.

Other fish species in Sculpin Spring are: rainbow trout (Salmo gairdneri), which spawn there in limited numbers; redside shiners (Richardsonius balteatus); peamouth chub (Mylocheilus caurinus), which spawn there in the spring; and largescale suckers (Catostomus macrocheilus).

Success of introduction:

Effectiveness of the Shoshone sculpin introduction was evaluated by monitoring the sculpin population in the spring for **a** year after the introduction was made. We were especially interested to see whether the Shoshone sculpin were able to successfully reproduce in the presence of a well-established population of mottled sculpin. Samples of sculpin were taken by electroshocking and dipnetting in November 1983 and February, April and September of 1984. We avoided sampling during the period of May-July when reproduction was likely to occur in order to avoid any disruption of spawning.

In November 1983, three months after their introduction, four (17%) of the 27 sculpin collected were Shoshone sculpin (Table 2). Mottled sculpin densities averaged 2.3 fish per square meter, very similar to densities in August 1983 prior to introduction of Shoshone sculpin.

Table 2. Numbers of sculpin collected in 1-m^2 frame set collections in Sculpin Spring, 20 November 1983.

Frame	C. greenei	C. bairdi	Maximum depth, cm.	Substrate-vegetation
1	1		70	50% gravel-cobble, 50% sand.
2	0	2	64	40% boulder, 50% gravel-cobble.
3	2	4	82	50% cress, 30% organic detritus
4	0	5	97	100% cress-silt
5	0	0	87	40% detritus, 20% cress.
6	0		63	60% gravel-cobble, 30% boulder.
7	1	1	84	60% sand-gravel, 30% cress.
8	0		62	60% boulder, 30% gravel-sand
9	0	1	49	75% cress-silt
10	0	6	90	90% cress.
	4 (17%)	23		

In 1984, water levels in Sculpin Spring were too high to enable use of the frame, and sculpins were difficult to capture. As many fish as could be taken were collected by electroshocking and dipnetting.

Shoshone sculpin showed the ability to maintain themselves and to reproduce in Sculpin Springs in the presence of an established mottled sculpin population. The April sample (Table 3) was inconclusive, as the numerous young-of-the-year sculpin approximately 10-15 mm in length were too small to enable identification to species without harming the fish. The September sample, however, clearly showed the presence of young-of-the-year Shoshone sculpin 35-43 mm in 1c oth. One young-of-the-year was taken which showed meristic counts characteristic of both species, likely indicating hydridization between the two sculpin species. Eighteen percent of the yearling and older sculpin were C. greenei, a percentage very similar to that in the November 1983 collection. Thus it appears that survival of adult Shoshone sculpin has been good over the 12-month period.

SUITABILITY OF SITES FOR FUTURE INTRODUCTIONS

Of the four sites currently identified for possible introductions of Shoshone sculpin, two (Devil's Corral and Vineyard Creek) are above Auger-Shoshone Falls and thus presumably outside of the original range of the species. The other two sites (Scott Ponds and Blue Lakes) are above the present distribution of the species but are below Auger-Shoshone Falls, presumably within their original range.

Scott Ponds

The Scott Pond property has recently been acquired by the Idaho Department of Fish & Game. The property lies on the north bank of the Snake River at RM 605.2 (Fig. 2) and consists of an abandoned hatchery

Table 3. Numbers of sculpin collected in Sculpin Spring in February-September 1984.

Date	C. greenei	C. bairdi	% C. greenei	Remarks
18 February	1	21	5	
21 April	0	15		An additional 17 young-of-year were taken which could not be identified
24 September	12	33	27	1 apparent hybrid also taken. 5 of the C. greenei were young-of-

system with a series of earthen raceways and a single large pond. The flow then drops abruptly to the Snake River and precludes fish entering the system from down stream. There is a small concrete raceway/header trough that is overgrown with watercress. The remaining raceways and the pond support heavy growths of the alga Chara. The large pond was full of water at time of inspection in August 1983; the other raceways were drained but water was flowing through them.

Water temperatures were 16^0 C in the header trough and warmed in the raceways, reaching 19.5^0 C as the water flowed into the large pond. If temperatures were to warm above this, Shoshone sculpin would be expected to leave the area or undergo stress.

The spring inflow and raceway system was checked for the presence of fish on 13 August 1983 and had been previously checked by us in 1981. No sculpin or any other fish were found at either time. A few rainbow trout are believed by local residents to still remain in the large pond.

Food for Shoshone sculpin appears to be abundant in the spring system. The amphipod Hyalella, which is the single most important ingredient in the diet of the species elsewhere, was very abundant. Other aquatic macroinvertebrates were rich and diverse.

Blue Lakes

Blue Lakes is a privately owned, spring-fed hatchery and small lake complex that drains into the north bank of the Snake River at approximately RM 611, between Auger and Shoshone Falls. We sampled the area in August 1983 and had previously inventoried there for sculpins in June of 1981.

Macroinvertebrate sampling indicated the presence of abundant amphipods in the standing water, and good diversity and numbers of

especially caddis flies and mayflies in the spring inflow areas. Water temperatures appeared adequate for Shoshone sculpin in the areas checked.

We found mottled sculpin present in high densities above and below the hatchery facilities, in the ponds, and in "Alphy's Creek". Some of the mottled sculpin were large, to 170 mm in length and likely prey on fish, including sculpins. Rainbow trout were collected above and below the hatchery and are probably abundant throughout the system.

Devil's Corral

Devil's Corral is a series of ponds and streams lying on private property immediately above Shoshone Falls and below the Twin Falls. Water drains from the springsin two streams that enter the north bank of the Snake River nearly a mile apart (approximately RM 616 and 617). The two streams appear to have separate spring sources, with the bulk of the flow entering at RM 617. We spent seven man-days in August 1983 conducting a biological inventory in both streams. In the larger (upper) stream, we collected two fish species, rainbow trout and speckled dace (Rhinichthys osculus). Rainbow trout were abundant and, although few were collected during elactroshocking, some were observed over 40 cm in length. Dace densities in frame net samples averaged 6 fish/m^2. In the smaller (lower) stream, speckled dace were the only fish species present. Densities were extremely high, averaging 8 fish/m^2 , and were the highest we have ever observed. No sculpin were found in any portion of Devil's Corral.

We sampled invertebrates in the upper portion of the larger stream. Aquatic vegetation was dense and was mainly in the form of the alga Chara.

Diversity and abundance of invertebrates in the Chara was low, with amphipods and damselfly and dragonfly nymphs (probably predators on sculpins) being dominant. Some crayfish were present. The number of amphipods was relatively low, possibly reflecting heavy utilization by the dace. In the smaller stream, the area sampled consisted of a narrow channel flowing through dense beds of watercress. Sediment depths, largely fine silt, were substantial, often greater than 30 cm. No amphipods were present; the most common invertebrates were caddisfly larvae of the genus Brachycentrus. Some crayfish were present.

The physical habitat in both streams appeared satisfactory for Shoshone sculpin, and water temperatures were adequate. The dense populations of speckled dace present, especially in the lower stream, may prevent successful introduction of sculpin; although no studies exist of possible competition between the two species, the dace have saturated the lower stream and apparently heavily cropped its food resources.

Vineyard Creek

Vineyard Creek flows into the Snake River from the north, entering at approximately RM 618. It is about 1 mile upstream from Devils Corral, with the Twin Falls of the Snake falling in between the two. Part or all of the surrounding land is administered by the Bureau of Land Management.

Fish species collected were young-of-the-year trout, probably rainbow-cutthroat hybrids, mottled sculpin, and speckled dace. Caddisflies and mayflies were the most abundant groups of aquatic insects collected, and food resources appeared to be adequate for Shoshone sculpin, as did water temperature and physical habitat.

Summary

From a biological standpoint, all four sites appear capable of sustaining a Shoshone sculpin population should the fish be introduced. However, each site has some pros and cons, as outlined below:

Site	Assets	Detriments
Scott ponds	*IFG ownership *no mottled sculpin or other possible competitors *within original range of Shoshone sculpin	*relatively little water flow *too warm at lower end *area may be developed by IFG in future, but this could enable enhancement as sculpin habitat
Blue Lakes	*large size could enable establishment of large sculpin population *within original range	*private ownership *presence of mottled sculpin (probably a minor concern after success in''Sculpin Spring)
Devil's Corral	*no mottled sculpin	*private ownership *high density of speckled dace *relatively inaccessible, **logistics** more difficult- *outside original range
Vineyard Cr.	*BLM ownership	*presence of mottled sculpin *outside of original range

LITERATURE CITED

Connolly, P.J. 1983. Life history of Shoshone sculpin in southcentral Idaho. M.S. Thesis, Univ. of Idaho. 79 pp.

Daley, D.M., J.S. Griffith, R.L. Wallace, and P.J. Connolly. 1982. Relative abundance and habitat preference of the Shoshone sculpin. Proc. 62nd Ann. Conf. West. Assoc. Fish & Wildlife Agencies. p. 601-610.

Wallace, R.L., J.S. Griffith, P.J. Connolly, D.M. Daley, and G.B. Beckham. 1982. Distribution, relative abundance, life history and habitat preferences of Shoshone sculpin. Report to U.S. Fish & Wildlife Service, Boise ID. 36 pp.

Wallace, R.L., J.S. Griffith, D.M. Daley, P.J. Connolly, and G.B. Beckham. 1984. Distribution of the Shoshone sculpin (Cottus greenei:Cottidae) in the Hagerman Valley of southcentral Idaho. Great Basin Naturalist 44(2): 324-326.